5

OPERATIONAL PROCEDURES

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In the interest of ensuring safety and increasing the utilization of capacity, the FAA continually modifies the procedures governing the operation of aircraft in the NAS. Modifications to existing operational procedures allow controllers to provide more flexibility to pilots in determining their routes, altitude, speed, and departure and landing times with little or no additional investment in airport infrastructure or air traffic control equipment. The FAA develops new operational procedures to implement changes in airspace design, to take advantage of improved aircraft and avionics performance, to maximize the utilization of a new runway, or simply to make the existing air traffic management system work more efficiently. These procedures are discussed in Chapter 5.

Several offices in the FAA are involved in developing and implementing new procedures. The FAA Aviation System Standards Office is responsible for developing and flight inspecting procedures for instrument approaches and departures at individual airports. These instrument flight procedures enable aircraft to continue operations during adverse weather. The Air Traffic Planning and Procedures Program develops standards for effectively implementing new air traffic procedures in the NAS. It recently began deploying a tool to assist air traffic facilities in the development of new arrival and departure procedures. At the national level, the FAA's Air Traffic System Command Center (commonly referred to as the Command Center) is responsible for coordinating air traffic by addressing localized problems through system-wide solutions. In the Spring/Summer initiatives for 2000 and 2001, the Command Center modified the processes that it employs to help minimize the traffic bottlenecks that occur when storms disrupt flights.

Although less expensive and time-consuming than implementing other capacity-enhancing solutions such as building new runways, the development and implementation of new procedures can be a complex process. The collaboration of the air traffic controllers and pilots who will be using the procedures is essential. In addition, both controllers and pilots must receive appropriate training before the procedures can be implemented.

5.1 Spring/Summer 2001

The Spring/Summer 2001 (SS2K+1) Plan is a continuation and enhancement of Spring/Summer 2000, a joint FAA/industry project begun in the spring of 2000 to maintain system predictability and capacity in times of severe weather, particularly during the summer when convective weather can cause flight disruptions nationwide. Key elements of the SS2K+1 Plan are described below.

5.1.1 Strategic Planning

The strategic planning team at the Command Center conducts conference calls with airline and air traffic control representatives every two hours, from 3 am to 11 pm, 7 days a week. During the call, the participants generate two- and six-hour system plans, taking into consideration potential problems caused by adverse weather or high traffic volume. The resulting strategic plan is posted on the Command Center web site. This function was also part of Spring/Summer 2000, but the number of conference calls has been expanded to cover a larger portion of the day.

5.1.2 Route Coordination

The FAA and the airlines have worked together to develop routing alternatives to facilitate efficient re-routing of traffic during severe weather. The availability of pre-determined alternate routes provides flexibility in dealing with most severe weather events and expedites the route coordination process. It also allows airlines to plan ahead for possible route changes when severe weather is forecast. The number of alternative routings has been increased since the summer of 2000. For example, the severe weather routes database now contains 215 possible routes from Boston Logan to 96 destination airports, compared to 114 routes to 38 cities available in 2000.

5.1.3 Collaborative Convective Forecast Product

The Collaborative Convective Forecast Product (CCFP) is a system for developing and distributing a single convective forecast four times a day. The primary goal of the CCFP is to improve coordination and decision-making for traffic management. The CCFP is designed to provide two- to six-hour forecasts of convective activity. It is not intended for use in tactical planning (zero to one hour). Forecasts are based on input from the National Weather Service's Aviation Weather Center (AWC), the FAA's Center Weather Service Units (CWSU), and airline meteorologists. Collaborative forecasts for the New York, Washington, Chicago, and Dallas areas are given top priority.

Training has been a key element of SS2K+1. Conceived during the Spring/Summer 2000 post-season review, the training's purpose was to explain the direction and goals of the SS2K+1 to all air traffic personnel. Airlines and support groups also received training to support the collaboration process. The FAA trained more than 15,000 air traffic controllers, traffic management specialists, air traffic managers, and airline ATC representatives on the technological improvements and system goals and expectations.

Keeping the flying public informed is another important aspect of SS2K+1. The public is now able to receive up-to-date information on the status of airport delays via the CNN airport news service as well as on the Command Center web site.

5.2 Reduced Separation Standards

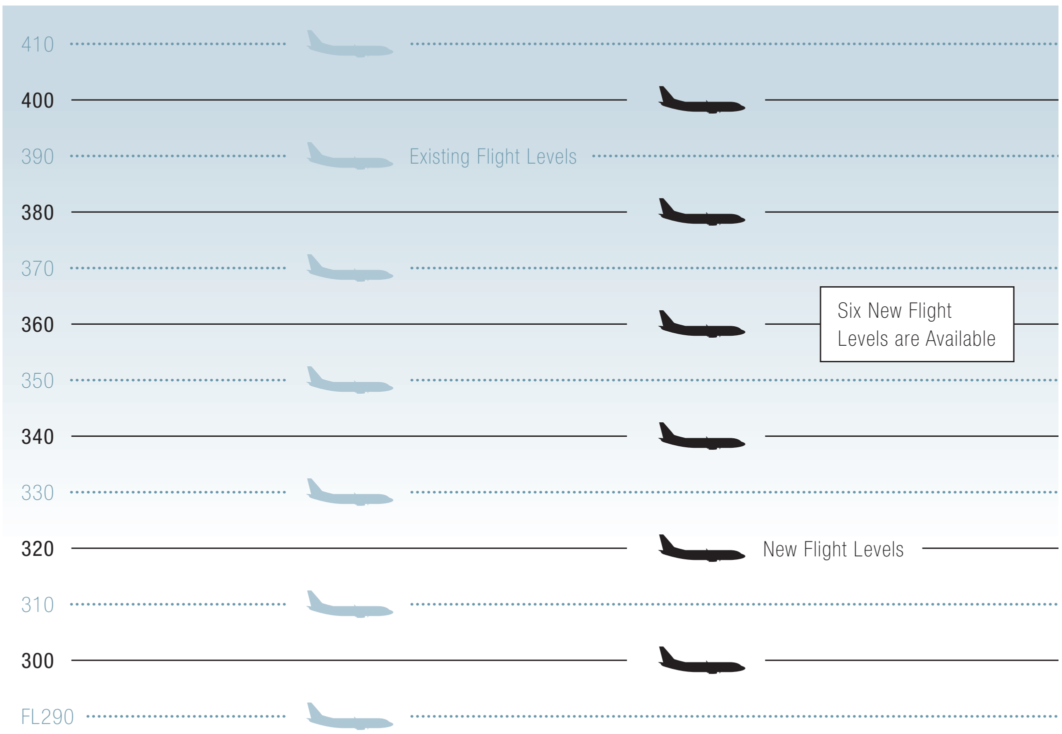
Reduced separation standards are being implemented incrementally in various regions to take advantage of technological advances that improve the accuracy and timeliness of position information available to pilots and air traffic controllers. Vertical and horizontal separation minima have been already been reduced in large portions of oceanic airspace. Reduction of vertical separation standards for U.S. domestic airspace is in the planning stages.

5.2.1 Reduced Oceanic Vertical Separation Minima

Procedures implemented more than 40 years ago required a 1,000-foot minimum vertical separation between IFR aircraft below FL290 and a 2,000-foot separation above FL290. The 2,000-foot separation above FL290 was necessary because the instruments used to measure aircraft altitude at that time had relatively poor accuracy at higher altitudes.

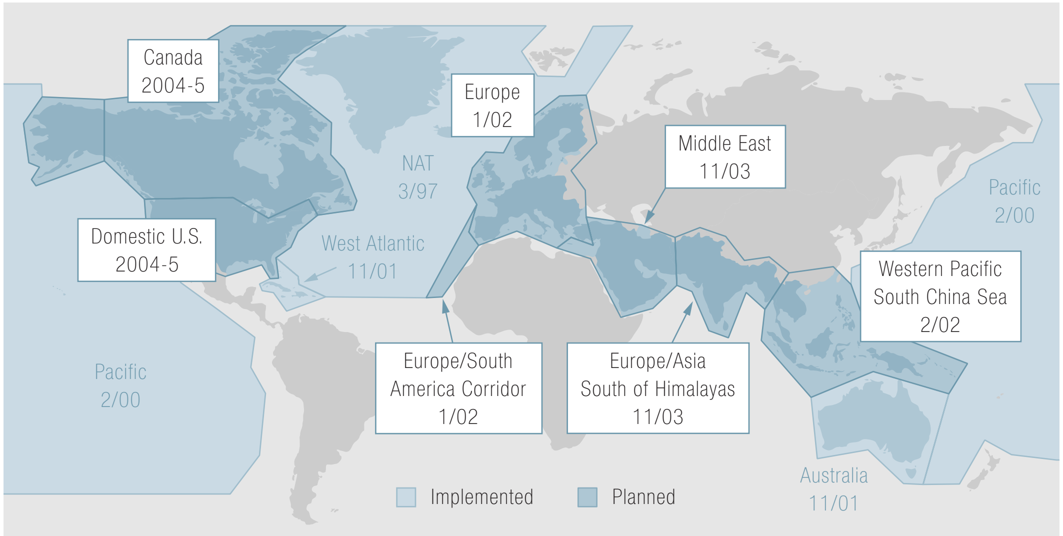
Over the past few years, the U.S. and other nations providing oceanic control, in cooperation with the International Civil Aviation Organization (ICAO) and international air carriers, have been reducing vertical separation minima from 2,000 feet to 1,000 feet in selected oceanic airspace. The goal of this initiative, called Reduced Vertical Separation Minima is to increase airspace capacity and to allow more aircraft to operate at fuel-efficient altitudes (Figure 5-1). To ensure that aircraft will be able to maintain separation, aircraft that want to participate in RVSM must meet stringent altimetry system standards. The height-keeping performance of participating aircraft is monitored under two main airways, using aircraft radar returns. Aircraft that do not pass through those monitoring areas are evaluated using portable measuring devices. Aircraft that are approved for RVSM are eligible to conduct RVSM operations worldwide. Approximately 23 percent of aircraft that operate in the U.S. above FL290 (2,500 of 11,100) are currently RVSM-approved.

Figure 5-1 Reduced Vertical Separation Minima to 1,000 Feet



RVSM is being phased in by altitude and airspace region. It was pioneered in the North Atlantic airspace. Aircraft crossing the North Atlantic fly along a highly organized route structure. Traffic flows primarily westbound from Europe in the morning and east-bound from North America in the evening. RVSM was implemented in the North Atlantic airspace from FL330 to FL370 in 1997 and was expanded to FL310 to FL390 in 1998. RVSM in the North Atlantic has successfully increased flight efficiency and resulted in user-estimated fuel savings of $32 million annually. Full implementation of RVSM for FL290 to FL410 in the North Atlantic is planned for January 2002.

Figure 5-2 RVSM Implemented and Planned



The Western Atlantic route system is a complex web of fixed routes that frequently experience high traffic volume. The heaviest traffic flow is North-South from the United States to Puerto Rico. RVSM in the Western Atlantic for FL310 to FL390 will be phased-in starting in January 2002, and expanded to include FL290 to FL410 later that year.

RVSM was implemented in the Northern Pacific from FL290 to FL410 in 2000. Projected fuel savings for U.S. carriers as a result of RVSM in the Pacific are expected to exceed $150 million annually. Figure 5-2 shows worldwide progress and plans for RVSM implementation.

5.2.2 Reduced Oceanic Horizontal Separation Minima

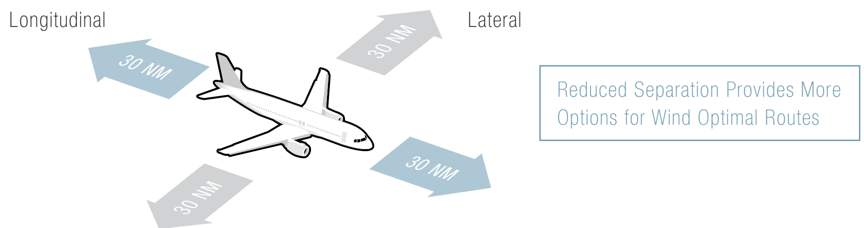
The current oceanic air traffic control system uses filed flight plans and position reports to track an aircraft's progress and ensure that separation is maintained. Position reports, sent by pilots over high frequency radio through a private radio service that relays the messages to the air traffic control system, are infrequent (approximately one per hour). Radio communication is subject to interference, disruption, and delay because radio operators are required to relay messages between pilots and controllers. These deficiencies in communications and surveillance have necessitated larger horizontal separation minima when flying over the ocean out of radar range.

As a result of improved navigational capabilities made possible by technologies such as the global positioning system (GPS) and controller pilot data link communications, both lateral and longitudinal oceanic horizontal separation standards are being reduced.

Oceanic lateral separation standards were reduced from 100 to 50 nautical miles in the Northern and Central Pacific regions in 1998 and in the Central East Pacific in 2000. The FAA plans to extend the 50 nautical mile separation standard to the South Pacific. Because flights along the South Pacific routes are frequently in excess of 15 hours, the fuel and time savings resulting from more aircraft flying closer to the ideal wind route in this region are expected to be substantial.

There are plans to reduce oceanic lateral and longitudinal separation minima to 30 nautical miles in portions of the South Pacific airspace by 2006 (Figure 5-3). These reduced separation minima will only apply to aircraft with sufficiently accurate navigation equipment (RNP-4),[5] controller to pilot data link communication, and enhanced surveillance capabilities provided by automatic dependent surveillance.

Figure 5-3 Reduced Oceanic Separation



5.3 U.S. Domestic Reduced Vertical Separation Minima

Planning began in 2000 on the phased implementation of reduced vertical separation in high altitude U.S. domestic airspace. In the first phase, domestic RVSM (DRVSM) will be implemented between FL350 and FL390, with a progressive extension to full DRVSM (FL290 to FL410).

As with RSVM in oceanic airspace, aircraft that operate in DRVSM airspace must demonstrate that they have certain communication and navigation capabilities and meet certain calibration standards. This will require new equipment such as altimeters and transponders and certification for nearly all aircraft that fly in RVSM airspace. Phased implementation will allow flexibility for operators of aircraft that will be costly to modify (particularly for GA users) or are not RVSM-approved at the beginning of the phase-in.

Prior to full phase-in, non-equipped aircraft will be able to operate below FL 350 or to pass through RVSM flight levels to operate normally above FL390. DRVSM will make six additional flight levels (for a total of 13) available and is expected to result in fuel savings of one percent. It will give controllers more flexibility in dealing with weather re-routes and will reduce delays associated with congested airspace above FL290. The FAA expects to begin the phase-in of DRVSM in December 2004.

Although a phased implementation is planned, the FAA is examining the possibility of implementing DRVSM from FL290 to FL390 at one time, with no phase-in, beginning in late 2004. This approach mirrors RVSM plans in Europe, where DRVSM is scheduled to be implemented in January 2002.

5.4 Increasing Civilian Access to Special Use Airspace

The FAA routinely works with the Department of Defense (DoD) to provide civilian access to special use airspace (SUA) when it is not being used by the military, through agreements concerning civilian access to specific SUA and the development of automated information systems that report on the availability of SUA. Civilian aircraft are normally sent over, under,

5 RNP-4 approved aircraft are equipped with navigation systems that can navigate within 4 miles of desired position with 95% probability.

or around special use airspace. By gaining access to SUA status information, pilots can sometimes avoid these deviations, saving both fuel and time.

As the volume of civil air traffic continues to increase, the pressure for close coordination between the FAA and the military intensifies. In recent years, the volume of airspace needed for testing of and training in military weapon systems has increased, although in many cases the amount of time that the military requires has been shorter.

In cooperation with DoD, the FAA has developed a computer information system, the Special Use Airspace Management System (SAMS) to provide pilots, airlines, and controllers with the latest status information, current and scheduled, on special use airspace. DoD operates the Military Airspace Management System (MAMS), which gathers information about SUA scheduling and transmits this data to SAMS. These two systems, working in concert, ensure that the FAA and system users have access to daily information on SUA availability on the internet. A prototype system called Special Use Airspace/In-Flight Service Enhancement would be used to disseminate graphic depictions of near-real time SUA information to airlines and GA users.

The Central Altitude Reservation Function (CARF) is another FAA component supporting military operations. SAMS handles schedule information regarding “fixed” or “charted” SUA while CARF handles ad hoc time and altitude reservations. Both subsystems deal with planning and tracking the military’s use of the NAS.

In July 2000 the FAA and the U.S. Navy began coordination to allow civilian use of offshore warning area airspace from Northern Florida to Maine to circumvent severe weather. To facilitate the use of this airspace, the FAA established waypoints in East Coast-offshore airspace along four routes for conducting point-to-point navigation when the DoD has released that airspace to the FAA. The waypoints take advantage of RNAV capabilities and provide better demarcation of airspace boundaries, resulting in more flexible release of airspace in response to changing weather. The offshore routes were tested and refined in November 2000 to ensure that no procedural problems existed before the 2001 Spring/Summer storm season.

In Texas, an operational trial to increase civilian access to the Brownwood and Westover military operations areas (MOAs) is in the planning stages. In this project, regional airline and GA participants will have the option of viewing the published, daily, and near-real time schedules of Brownwood and Westover MOAs via the internet. Based on this information, airspace users can make better-informed pre-flight decisions regarding flight planning and fuel loading, and in-flight decisions regarding routing in the vicinity of these two MOAs.

Operational trials to increase civilian access to SUA are also being conducted at Edwards Air Force Base in California, the Buckeye Military Operations Area in Ohio, and the Palatka Complex in Florida. The purpose of all these trials is to implement more efficient, timely, accessible information systems to give civilian users more access to military airspace when it is not in use.

5.5 Area Navigation (RNAV) Approaches

The FAA is developing RNAV instrument approaches that do not require the use of ground-based navigational aids to capitalize on GPS capabilities. The RNAV approach procedures are being published in new instrument approach charts intended for all aircraft. The new approach charts include lateral navigation (LNAV) and lateral navigation/vertical navigation approaches (LNAV/VNAV). An LNAV approach is a non-precision approach (no vertical guidance) with a minimum descent altitude of 250 feet above obstacles on the flight path protected area. LNAV approaches can be conducted today with approach-certified GPS receivers. The FAA has published 2,732 LNAV approaches at general aviation airports, of which 37 percent are at airports with no vertically-guided instrument approaches and no previous straight-in instrument approach capability. An LNAV/VNAV approach is a vertically-guided approach with a decision altitude down to 350 feet or higher above the runway touchdown point, requiring a Wide Area Augmentation System (WAAS) certified receiver (not yet available) or certain flight management systems (FMS) with barometric VNAV. The LNAV/VNAV procedure falls between a non-precision approach with no vertical guidance and a true precision approach. LNAV/VNAV approaches allow more stable descent paths than traditional non-precision instrument approaches. The development of LNAV/VNAV approaches is a strategy to help reduce the risk of controlled flight-into-terrain at airports without an ILS, or when an ILS is out of service. In addition, the development of these approaches at airports that do not currently have an ILS increases access to these airports under low-visibility conditions. The FAA has published 234 LNAV/VNAV approaches.

The new RNAV approach charts will also include precision approaches using WAAS when it is certified for category I precision approaches. WAAS was intended to allow ILS-like CAT I approaches to 200-foot decision altitude and one-half mile visibility at airports with the appropriate lighting systems and runway markings. Although system accuracy has consistently exceeded CAT I standards in recent tests, system integrity has not yet met certification standards. Integrity describes the system's ability to detect a problem with the navigation signal and warn the pilot quickly.

It is unclear when WAAS will be able to provide CAT I capabilities, but WAAS is expected to deliver LNAV/VNAV approaches to U.S. airports by 2003. The availability of LNAV/VNAV approaches made possible by WAAS will greatly increase safety and access at smaller airports that do not have instrument approaches with vertical guidance.

5.6 Approaches to Closely Spaced Parallel Runways

At airports with closely spaced parallel runways, capacity is constrained in low-visibility conditions. When visibility is good pilots can conduct visual approaches to closely spaced parallel runways. But during periods of low visibility, simultaneous approaches to closely spaced parallel runways monitored by conventional airport surveillance radar are not permitted. For parallel runways separated by 2,500 feet to 4,300 feet, two arrival streams can be maintained but operations are limited to parallel dependent instrument approaches using 1.5 mile staggered separation. For parallel runways spaced less than 2,500 feet apart, operations are restricted to one arrival stream, which effectively reduces the airport's arrival capacity to one-half of its capacity in visual meteorological conditions. To help reduce the negative effect of adverse weather on arrival capacity, the FAA has developed several approach procedures that take advantage of the enhanced surveillance capability of the precision runway monitor (PRM).

The PRM is a surveillance radar that updates essential aircraft target information four to five times faster than conventional radar equipment. Using the PRM to monitor operations allows air traffic controllers to ensure safe separation of aircraft on parallel approach courses and maintain an efficient rate of aircraft landings on closely spaced parallel runways during adverse weather conditions. The FAA has commissioned PRMs at Minneapolis and St. Louis, and most recently, at Philadelphia International Airport in September 2001. PRMs are scheduled for commissioning at San Francisco and John F. Kennedy in mid-2002, and Atlanta in 2005, coincident with the completion of the fifth parallel runway.

The FAA has approved the following procedures utilizing a PRM to allow simultaneous instrument approaches in adverse weather:

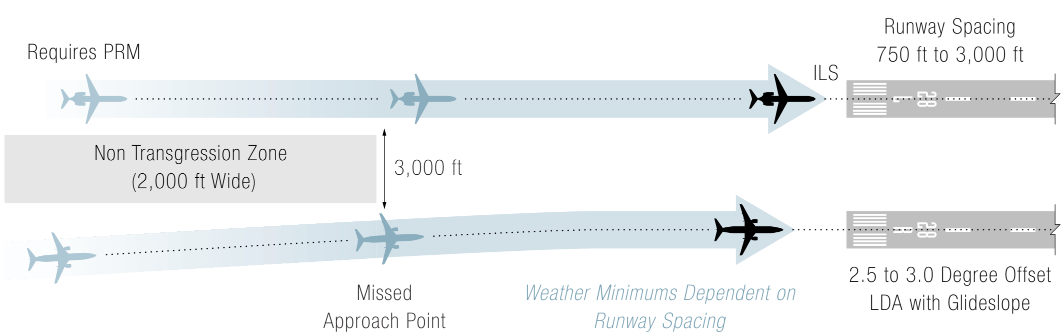
- Dual simultaneous instrument approaches for 4,300 feet-3,400 feet spacing (applicable to Minneapolis and the proposed new runway at St. Louis)
- Dual simultaneous instrument approaches down to 3,000 feet spacing with one instrument landing system (ILS) localizer offset by 2.5-3 degrees (proposed for Philadelphia and John F. Kennedy)

Two additional initiatives to allow better utilization of closely spaced parallel runways in low-visibility conditions include the simultaneous offset instrument approach (SOIA), and along track separation procedures. SOIA procedures have been developed but not yet implemented, and along track separation is at the conceptual stage of development.

5.6.1 Simultaneous Offset Instrument Approaches

The SOIA procedure would allow simultaneous approaches to parallel runways spaced from 750 feet to 3,000 feet apart. It requires the use of a PRM and an offset ILS localizer and glide slope (Figure 5-4). It requires the use of a PRM, a straight-in ILS approach to one runway, and an offset localizer directional aid (LDA) with glide slope approach to the other runway (Figure 5-4).

Figure 5-4 Simultaneous Offset Instrument Approaches



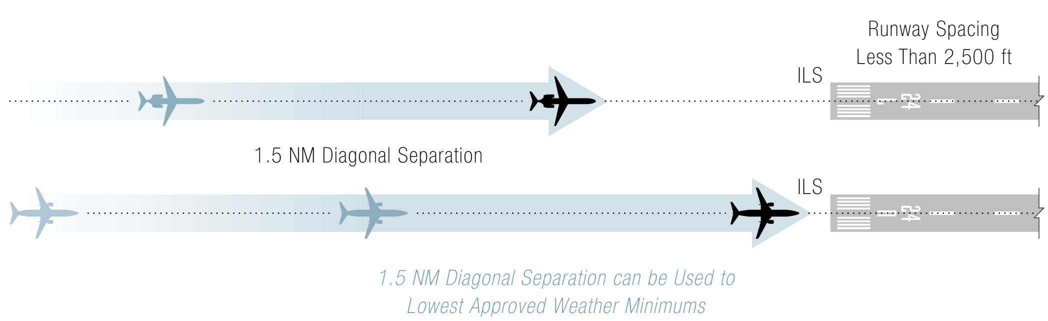
The SOIA concept involves the pairing of aircraft along adjacent approach courses separated by at least 3,000 feet with a designated missed approach point approximately 3.5 nautical miles from the runway threshold. The pilot on the offset approach would fly a straight-but-angled approach until descending below the cloud cover. At that point, the pilot would have a period of time to visually acquire the traffic on the other approach before continuing to the runway. If the pilot does not see the other aircraft before reaching the missed approach point, the approach would be discontinued.

San Francisco International Airport (SFO) is the first candidate airport for SOIA. At SFO the arrival rate is 60 aircraft per hour in clear weather using both parallel runways, which are 750 feet apart. In times of heavy fog and low-ceiling conditions, aircraft are placed in-trail to one runway, reducing the airport arrival rate by half. The SOIA procedure will enable SFO to maintain an arrival rate of up to 40 aircraft per hour with a cloud base as low as 1,600 feet and four miles visibility. The FAA has completed flyability, collision risk, and preliminary wake turbulence analyses for the SOIA procedure, but the PRM has not yet been commissioned. The PRM is expected to be operational by mid-2002. Other potential sites for SOIA include St. Louis, Newark, Cleveland, and Miami airports.

5.6.2 Along Track Separation

Along track separation is a proposal to increase arrivals to parallel runways spaced less than 2,500 ft. apart in periods of low visibility. The procedure entails parallel dependent instrument approaches staggered down to 1.5 nautical miles diagonally (Figure 5-5). The relevant safety analyses have not yet been conducted to determine whether a PRM would be required for this procedure to ensure safe separation.

Figure 5-5 Along Track Separation

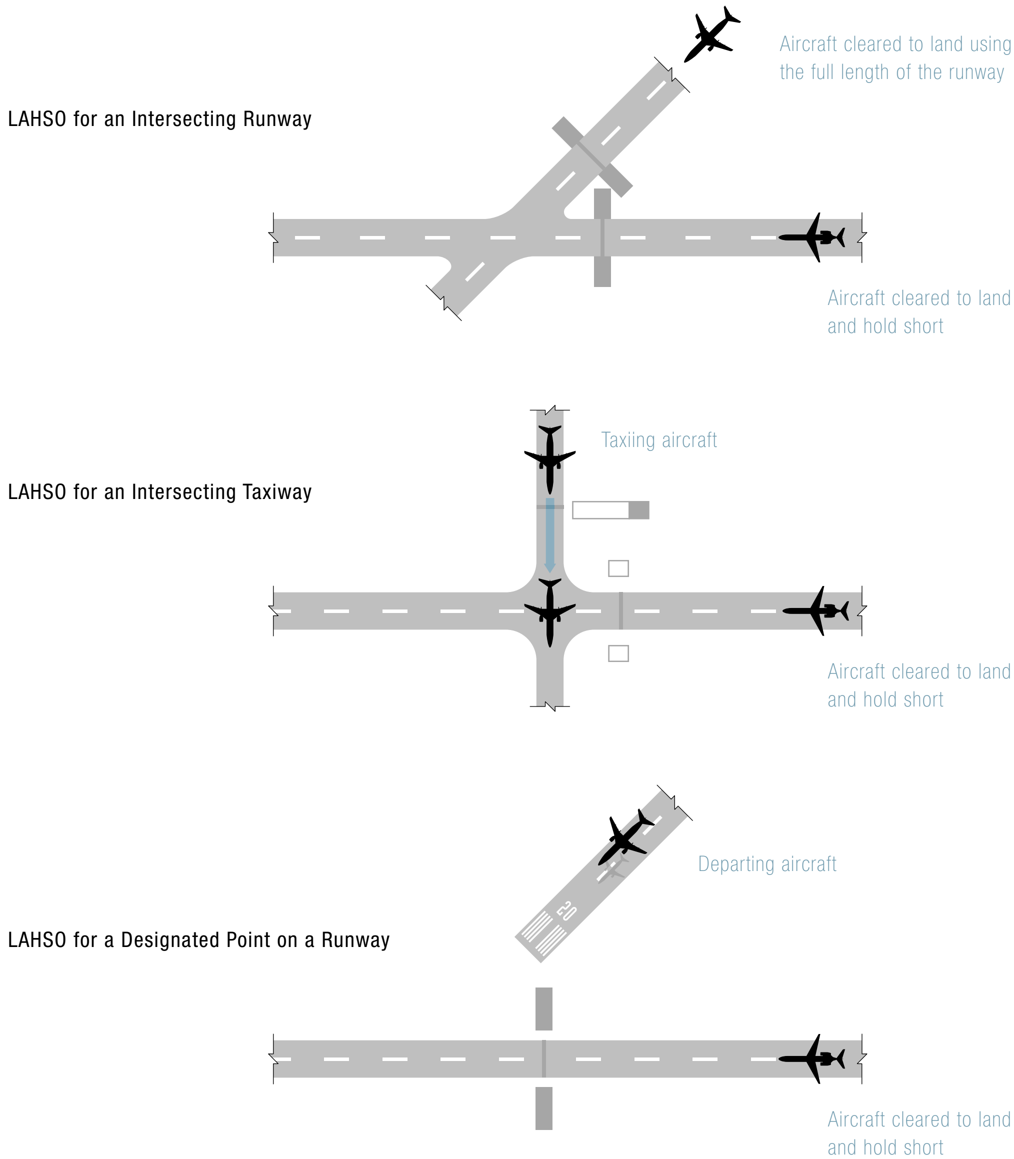


5.7 Land and Hold Short Operations

More than 30 years ago, the FAA began allowing simultaneous operations on intersecting runways, under restricted conditions, at a number of U.S. airports. Under this procedure, aircraft landing on an intersecting runway stop at a designated point before the intersection, allowing aircraft on the other runway to take off or land freely. This procedure increases airport acceptance rates by capitalizing on the fact that the full runway length is not necessarily required for an aircraft landing.

In 1997, the procedure was expanded to include landing and holding short of an intersecting taxiway, approach/departure flight path, or predetermined point on the runway other than a runway or taxiway, under the designation land-and-hold-short operations (LAHSO). The pilot-in-command retained the final authority to accept or decline any LAHSO clearance (Figure 5-6).

Figure 5-6 LAHSO Takeoff and Landing Procedures



In February 1999, the FAA, in coordination with the Air Transport Association (ATA) and the Air Line Pilots Association (ALPA), made a number of changes to the LAHSO procedure, such as limiting LAHSO to dry runway conditions.

In August 2000, the FAA issued revised standards containing three additional substantive changes. First, the means of determining the minimum available landing distance was modified so that the longest possible landing distance plus an additional safety margin will be used to determine whether LAHSO can be conducted for a given aircraft at a specific runway. Next, the new standards allow participation in LAHSO only by pilots who have been adequately trained in the maneuver. While most air carrier pilots have already been trained in LAHSO, the FAA needs to ensure that the remaining U.S. air carrier pilots and general aviation (GA) and foreign air carrier pilots receive adequate training. As of July 2001, mixed air carrier/GA LAHSO operations were still not being conducted due to training requirements for GA pilots. The training is expected to take two years to be completed.

The third substantive change was a requirement that no LAHSO be conducted on runways that require a rejected landing procedure until the procedure has been scientifically modeled and verified. Rejected landing procedures are required for airports where the geometry of the intersecting runway raises the possibility that each airplane would be in the air over the intersection at the same time. This last requirement has had a noticeable adverse impact on capacity at certain large airports. At the 19 largest U.S. airports, 39 intersecting runways where LAHSO was previously conducted require a rejected landing procedure. For example, about a quarter of Chicago O'Hare's daily operations were previously conducted on two intersecting runways (14R and 27L) in rapid succession when weather conditions permitted. Planes arriving on runway 14R stopped short of the intersection when an aircraft was departing on runway 27L. Because a rejected landing procedure is required, LAHSO has not been available for this particular runway combination. Similarly, the loss of LAHSO resulted in a reduction of six operations per hour at LaGuardia, and eight per hour at Boston under commonly used runway configurations. Other airports significantly affected by restricted use of LASHO include Philadelphia and St. Louis.

Modeling of rejected landing procedures for Chicago O'Hare, LaGuardia, and Miami indicates that the required margin of safety cannot be reached to make simultaneous LAHSO work. For example, modeling at O'Hare showed that if the arriving aircraft is more than 1.5 miles from the runway threshold, the departing aircraft can be cleared for takeoff safely. However, if the arriving aircraft is closer than 1.5 miles when the departing aircraft begins to takeoff, the two aircraft could possibly collide. An alternative to simultaneous LAHSO currently being explored is dependent LAHSO. Controllers would be permitted to clear a departing aircraft for takeoff before an arriving aircraft reaches 1.5 miles of the runway, or to clear the takeoff once the arriving aircraft is on the ground. Takeoff clearance would not be given during the last 1.5 miles of the arriving aircraft's approach.